DOCUMENT RESUME

ED 480 008 CE 085 331

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TITLE Implications for Women and Children When Mothers Return To Study Mathematics.

PUB DATE 2001-00-00

NOTE 7p.; In: Schmitt, M. J. and K. Safford-Ramus (Comps.) (2001). Adults Learning Mathematics-7: A Conversation Between Researchers and Practitioners. Proceedings of ALM-7, the International Conference of Adults Learning Mathematics (7th, Medford, MA, July 6-8, 2000) p. 167-172. The conference was hosted by the National Center for the Study of Adult Learning and Literacy (NCSALL) at Harvard University in conjunction with the Tufts University Department of Education and the NCTM-affiliated Adult Numeracy Network.

AVAILABLE FROM Peppercorn Press, PO Box 693, Snow Camp, NC 27349 (Papers not sold individually, for complete volume: ISBN 1-928836-10-0, $25).

PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)

EDRS PRICE EDRS Price MF01/PC01 Plus Postage.

DESCRIPTORS Adult Basic Education; Adult Development; Adult Education; Adult Programs; *Adult Students; Educational Attitudes; Individual Development; *Mathematics Education; *Mothers; Numeracy; Parent Influence; *Parent Role; *Parent Student Relationship; *Reentry Students; Self Concept; Student Educational Objectives; Student Role; Teacher Role; Theory Practice Relationship; Womens Education

IDENTIFIERS Australia

ABSTRACT

In an attempt to understand the intellectual experiences of women returning to the education system to learn mathematics, data were collected from 11 women in 2 adult mathematics class in Australia who were early school leavers between the ages of 35 and 50 with between 1 and 4 children ranging in age from 2 to 17. Participants were interviewed after three weeks of class observation and at the end of the courses about their perceptions of mathematics; the role of the learner, teacher, peers, and assessment in their learning; as well as their reasons for returning to study; their previous school experience; and the influence of parents on their schooling. One of the motivating factors for returning to study mathematics for 7 of the 11 participants was to support their children academically, including wanting to be a good role model and wanting to break the cycle of learning difficulties. Findings suggest that having older children at home can encourage adult learners to verbalize their mathematical thinking; that when the home academic environment improves so do the benefits for children's mathematical achievements; and that women's intellectual growth may be intimately connected to being able to support their own children's development. (The document includes 2 case studies and discussion of them, as well as 15 references.) (MO)

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Implications for Women and Children When Mothers Return to Study Mathematics

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Introduction

This paper is part of a larger research project that seeks to integrate two feminist epistemological frameworks: Belenky, Clinchy, Goldberger, and Tarule (1986) and Baxter Magolda (1992). The aim is to provide an epistemological lens through which to understand better the intellectual experiences of women returning to study in the further education sector, with a particular focus on the learning of mathematics. One of the motivating factors in the women's reasons for returning to study mathematics was to support their children academically and this motivation appears to support the women's own intellectual growth. This is an issue that has received little attention to date.

The theoretical background to the study is consistent with current writings in the "women and mathematics" area that call for strategies to counter traditional mathematics pedagogy and epistemology which has alienated many girls and women by not appreciating or validating their ways of coming to know (Becker, 1996, Burton, 1996). This direction is also consistent with current writings on mathematics education more generally that is focused on investigating the socially situated and cultural aspects of learning mathematics (Cobb & Bauersfeld, 1995; Mercer, 1995). Becker (1996) suggested that the frameworks of Belenky et al. (1986) and Baxter Magolda (1992) might prove fruitful in future research on gender and mathematics. A tentative integration of the models has been proposed in the context of the adult mathematics classroom and the reader is referred to Brew (1999; 2000) to provide background reading.

Baxter Magolda (1992) described the shifting role of significant others (peers, teachers) and the changing nature of students' perceptions of knowledge as shifts in their epistemological perspectives occurred. For example, Absolute knowers, those who hold the perspective that knowledge is certain and that it is derived from external authorities (e.g., the teacher), do not tend to view peers as holding legitimate knowledge. Rather, the role of peers is mainly social and to share what they have learned from the teacher. Transitional-Independent knowers, described as shifting their perspective to viewing knowledge as uncertain, are more open to hearing peers' views—alternative perspectives—and expect the teacher to facilitate peer interaction. In this paper the role of children is tentatively proposed as a further significant other for women with children returning to study, extending the framework of Baxter Magolda (1992).

In the study by Baxter Magolda (1992) on the pathways of intellectual development of college students, children were not discussed and Belenky et al. (1986) only did so briefly. In a more recent study, Belenky (1996) noted that programs set up by midwife teachers to provide self help networks had a positive impact on the relationship between the women and their children. These positive impacts were traced to changes in the women's ways of knowing.

> These women influenced their children's behaviour by engaging them in reflective dialogue, drawing out their problem solving abilities. By contrast, the women who did not see themselves as thinkers seemed much less aware of their children's thinking processes. They relied almost exclusively on authoritarian, power-oriented child rearing techniques....These programs might well lead to more democratic families and the ripple effect will be felt down through the generations. (Belenky, 1996, pp. 396-397)

The lower school achievements of the children of working class parents are generally described within the context of "social reproduction" theories (Burns & Scott, 1997). One perspective describes a deficit model in which parents are proposed to value education less highly and to have lower aspirations for their children. Another perspective put forward is that working class parents lack knowledge and confidence to be involved in their children's education due to limited or poor school experiences (Marjoribanks, 1995). Social reproduction

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theory does tend to assume that a family's class position is generally fixed by early adulthood based on occupation/education and the associated values acquired by the parents-to-be (Burns & Scott, 1997). These researchers ask, "... but what happens when social class becomes more fluid, and parents markedly raise their own educational status after their children are born? Do the children inherit their old level of cultural capital or the new level?" (Burns & Scott, 1997, p. 210).

According to Crane (1996) the relationship between home environment and mathematical skills is not well documented though Reynolds and Walberg (1992) found for grade 8 students it had the largest indirect effect. In the study by Crane (1996) the effect of the home environment was also large, particularly when the children were younger, though for older children it had significant effects as well. Crane (1996) suggested that further research was required to find ways to influence the home environment to enhance young people's mathematical competence, as the outcomes could be potentially large.

Mature age women who complete tertiary courses commonly report gaining new confidence, greater understanding, wider interests, and better conversation skills (Burns, Scott, & Cooney, 1993; Kelly, 1987). Burns and Scott (1997) also presented evidence that for women in the tertiary education context there is a substantive flow-on effect to children, particularly for older children. Apart from specific tutoring skills, most respondents emphasised more global factors such as their influence as a role model, their increased ability to understand the child's thinking, and the more intellectual climate in the household. This paper provides evidence of similar outcomes in the academic step prior to tertiary study—the further education sector—with a focus on the learning of mathematics.

Participants and Data Collection

Data were collected from 11 women enrolled in one of two adult mathematics classes at a Community Learning Centre, Melbourne, Australia. One class covered basic mathematics as a component of a full time Information Technology course; the other class was equivalent to secondary school grade 11 mathematics. Eleven women ranging in age from 33 to 50 years old participated and nine were early school leavers. These women had one to four children at home ranging in age from 2 to 17 years. After three weeks of class observations participants were interviewed about their perceptions of mathematics, the role of the learner, teacher, peers, and assessment in their learning, as well as their reasons for returning to study, their previous school experiences, particularly in mathematics, and the influence of parents on their schooling. Regular observations of classes continued to the end of the courses and final interviews were by telephone. The role of children emerged spontaneously as a strong theme in interview 1 despite not being an initial focus and this was followed up more systematically in interview 2. Interview 2 focused on any perceived shifts in the students' epistemological perspectives on the role of the teacher and peers in their mathematical learning and also on the role of children in their studies.

Findings

Apart from personal and financial motivations, seven of the 11 women stated that one reason for returning to study was to better support their children's academic studies. This was usually stated in terms of wanting to help them with their homework but more global issues also emerged such as wanting to be a good role model and wanting to break the cycle of learning difficulties that they themselves had suffered.

In either the first or second interview, six women reported that their goal to better support their children with their school work since undertaking their mathematics course did eventuate. Four of these women also said they had obtained similar assistance from their older children. The women's discussion of their interactions with their children suggested that the quality of their conversations was changing. From here I focus on two case studies, Linda and Samantha, to illustrate the nature of these changing interactions.

Case Study 1

Linda was in her early 40s, married with three children ranging in age from 6 to 14 years old, and was enrolled in the Informational Technology course. Linda described a difficult secondary school experience in a poor and rough working class suburb. In terms of the notion of social reproduction theory, her parents seemed to have

had both low educational aspirations for their daughter and lacked the knowledge and confidence to be involved in her education. Linda's aim in returning to study was motivated, in part, to break this cycle.

> I: How did your parents influence you in your studies?
> *They didn't sort of worry, ... like school was supposed to take care of that. It wasn't to be brought home. Occasionally I had trouble and my homework wasn't done and Dad would sit down and try and help do it. But for Mum, well, wouldn't be able to. You were a girl and you were going to finish in fourth form (grade 11) anyway and go on and do office studies.*
> I: Is that what they used to talk to you about?
> *Yes. Dad would say, "well, you are not doing any good so, as soon as fourth form comes up you are out of there." Not to say sort of, "why aren't you doing well in maths."*
> *The business went broke so obviously I had to get out there and just move myself. A bit of reality sets in and the old pay packet gets a bit thinner (laugh)... and I just needed my brains to get working. ... the kids were coming home and talking and some days I was just switched off. And I thought this is hopeless, ... I am just stagnating. ... With my son he is 14 now and I have noticed his work is becoming a bit daunting, and I felt the need to sort of help him, whereas, my parents didn't do that.*

In the second interview Linda's comments resonate with the notion of the development of a genuine voice, and a moving away from *Silence*, epitomised by a sense of feeling dumb and stupid (Belenky et al., 1986). With this shift in perspective came greater honesty in Linda's relationship with her son. What is critical in the context of this paper is how her greater confidence with mathematics was integral to this process, though returning to study, in general, undoubtedly contributed. Linda also reported that her two daughters (one a pre-schooler and the other junior primary level), were also influenced in a positive way by her return to study as they enjoyed simulating her homework activities.

> *I feel more self-assured and speak out a bit more than I used to. Whereas I tended to hang back and think I better not say that because that might be stupid. ... Speaking to my son I speak out more about schooling than I did before, in the way that he should think about school.*
> I: In the first interview you said his work was becoming daunting. Are you able to help him now?
> *Yes. I am now because he is doing similar things to what we did last year. Working out the areas, perimeters. Actually we were only doing that yesterday, and I thought "Wow, I did this! I can do this with you." ... he is actually asking me questions (laugh).*
> I: So that wouldn't have happened before?
> *I probably would have looked at it and gone "Ask your father." Whereas now, ... I haven't had to say "wait till your father comes home" or "don't show me that."*
> I: Did you say that, don't show me that?
> *Oh yeah. ... A couple of times I have said "I haven't got time for that" only because (voice dropped) I didn't really know what he was talking about. ... But now I can read it, say "all right, lets have a look," and work it out.*

Evident in Linda's comments below is an apparent belief that culturally she should be thinking of her own personal academic goals as being separate from those of her children's. Yet for Linda her personal and academic goals were intimately connected to those of her children in her decision to return to study.

> I: You said in the first interview that the kids were coming home and talking and you were just switched off, you thought this is hopeless. It sounds like the kids kind of triggered you in some ways?
> *Yeah you do things for your family ... well I did it for myself I suppose ideally, but in the back of your mind ... like I had this mundane job, ... I had to get out there ... improve myself. FOR the kids.*

Having completed the course Linda applied successfully for a part time office worker position.

> *The family was saying oh they won't pick you, you are too old ... the first interview I came back and I said "I got that job!" (laugh). They just looked at me. I mean my husband was very supportive, but the rest of my family they were just astounded. ... they said, "Mum, I am so surprised, I really didn't think you would get anything." They were quite open about it. And it is so good for the children to see ... hey if you go back to school ... you put the time in, you do get something better.*

Case Study 2

Samantha was in her early 30s and was married with three children ranging in age from 8 to 15 years old. Samantha was enrolled in the grade 11 mathematics and wanted to pursue a teaching career. Samantha attended a remote rural school and left in grade 9. She described an uncomfortable relationship with mathematics at school and is aware of, and concerned about, similar patterns of thinking emerging with her children with respect to low academic confidence. A somewhat Absolute orientation towards mathematical knowledge is also evident.

> *Maths is a lot of things that don't make sense, that somewhere in the end they do. ... You have to abide by the rules to get that solution, you can't go off and make up your own rules ... I remember sitting in the maths room and quaking in fear of all this big maths that we were going to learn, in the very early stages of year 7. I just remember walking to class from assembly and thinking, "Oh, I don't know if I can do this." That's funny, because I hear by kids saying it now and I say "yes you can, yes you can."*

Samantha described how her motivation to return to study was intimately related to her children's education, particularly mathematics.

> *I realised they are requiring different things of me. They are not requiring to have their nappy changed, mashed food on the table, they are requiring a more intelligent person to be around them. I decided I had the life experience, probably I needed to brush up on the academic aspect. That has encouraged me more than anything and I think maths is definitely an area where I need to be knowing what they are doing.*

At the time of the first interview Samantha had already experienced a shift in the types of conversations she was having with her oldest son. These interactions are somewhat consistent with the role of peers for the Absolute-receiver orientation, knowledge obtained from the teacher can be shared. The apparent focus on genuine engagement with understanding, and the verbalising of uncertain knowledge, also suggests the emergence of a Transitional inter-personal orientation.

> *I have interesting conversations with my oldest son now, where I can't understand something he'll say "have you seen this or have you done that?"... And yet there will be times when I say "can you help me with this?" ... And he will say "what is that?" And I can teach him where I am up to but I can't go the next step. We've shared. That is important to me. I want the kids to know they are not on their own.*

As I became more aware from the initial interviews about the role of children in the women's study life I asked the participants at the next observational visit to tell me whenever they had conversations about mathematics with their children. The day I requested that input Samantha revealed that her 14 year old daughter (grade 8) had come home that week and announced that she had excelled in an Algebra test. Samantha said her daughter normally failed such tests. When this outcome was followed up in interview 2 her daughter had clearly moved ahead in her mathematical studies, yet Samantha did not believe that her daughter would consider that she had been influential.

> *I think it would be a refusal comment to say that mother helped (laugh). Mothers don't get much credit when they are this age. But ... she has become more open to realising that maths can be fun even if it is tough. ... to the point where she has gone from not understanding the concept of maths at all, to doing a lot of maths that was at my level. Her maths teacher said, "I want her in my advanced maths class next year." ... But I don't know if the credit would directly come back to me. I think the environment of seeing maths as being a regular thing in my house, my books over the table, my determination, the late nights, and the successes in the end have inadvertently led to an openness for the subject.*

In interview 2 Samantha described a shift with respect to the role of the teacher and this was linked to her peers' mathematical knowledge gaining greater legitimacy. Her reflections suggest an epistemological shift towards a Transitional inter-personal orientation.

> *The teacher was definitely the primary source of information, ... but when it came to making the maths real it was from talking.*
> I: Can you think of any examples in the class when you discussed maths together?
> *Yes I can. We were all trying to grasp something and we couldn't.... It was algebraic, ... like and unlike terms. It came down to Denise explaining it in terms of apples and oranges (laugh). Everyone all of a sudden understood it ... The teacher agreed she couldn't have explained it any better. ... it kept coming back ... that Denise was a very good teacher ... it was amazing. Wow! I know the teacher had been able to break through on a number of things ... but this was US working it out, US describing it to each other.*

Samantha also described a very satisfying application of her new mathematical knowledge in her everyday life. Evidence of perhaps a further shift into an Independent knowing perspective emerged, epitomised mathematically here by valuing alternative ways of solving a problem, while at the same time valuing her own method equally. What I think is also important to note is how mathematics was used by Samantha to demonstrate a new sense of her own intellectual space.

> *My husband was asked to build tables to accommodate some computers. Now it took a lot of maths to work this out ... you had a big pole in the middle and around it you had to build six units to come together neatly.... So the whole thing had to be done by way of angles. My husband ... credits himself with working it out, but he worked it out by his logic as a builder. And then I was able to work it out through using angles and the laws of circles to make sure what he had worked out was correct. ... It was really frustrating to start with, like what did I learn? But it all worked out, ... we were so accurate that the people who cut the timber could not get it right. ... That was a good example of putting something I had learnt into practice in a very practical way and seeing the end result was perfect.*

Discussion

What I hope to have conveyed is that for women returning to study mathematics, having older children at home can provide a fertile environment to encourage them to verbalise their mathematical knowledge and understanding. In the classroom, encouraging women to verbalise their mathematical thinking can be quite challenging for adult practitioners and this may provide a fruitful avenue to explore.

Also evident from the extracts provided is that dramatic changes in children's attitudes towards and achievement in mathematics can occur. These findings support the assertions of Crane (1996) and Reynolds and Walberg (1992) that when the home academic environment is improved the benefits for children's mathematical achievements are potentially quite large.

Finally, the experiences of the women suggest that their intellectual growth is intimately connected to being able to better support their own children's development. For the two case studies discussed, these women did create a new sense of independence and their own personal intellectual space. What is significant is the extent to

which their new mathematical knowledge and their motivation to support their children played a crucial role in creating this for themselves.

Acknowledgments

This study is supported by a La Trobe University postdoctoral fellowship grant. To the students and the teacher who participated in the study, thank you for your generosity, and to my mentor, Gilah Leder, for providing me with helpful comments on earlier drafts of this paper. I would like to acknowledge the financial assistance of the U.S. Department of Education, Washington, D.C., and the Centre for Research for Women, Edith Cowan University, WA, Australia, for making it financially possible for me to attend the Seventh Annual Adults Learning Mathematics Conference held in Boston, MA, July 2000.

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